

MATH 503: Introduction to Discrete Mathematics

Course Material and Topics:

Discrete mathematics (combinatorics) is a fundamental mathematical discipline as well as essential component of many mathematical areas, and its study has experienced an impressive growth in recent years. While in the past many results in this area were obtained mainly by ingenuity and detailed reasoning, the modern theory has grown out of this early stage and often relies on deep, well-developed tools.

The main aim of this course is to introduce many core ideas from this topic, such as extremal set theory, Ramsey theory and design theory as well as some of the dominant proof techniques such as probabilistic methods and algebraic methods.

The course outline follows (with sections taken from Lovasz' book) with approximately 1 to 2 lectures being spent on each topic.

- Basic enumeration methods (section 1)
- Connectivity in Graphs and Menger's theorem (section 6)
- Factors of Graphs and Tutte's theorem (section 7)
- Graph colourings and perfect graphs (section 9)
- Block designs and Wilson's theorem
- Extremal graph theory and Turan's theorem (section 10)
- Strongly regular graphs and algebraic methods (section 11)
- Hypergraphs and extremal set theory (section 13)
- Ramsey Theory and probabilistic methods (section 14)

Learning Objectives:

- (1) Understand the basic ideas of extremal set theory, Ramsey theory and design theory.
- (2) Understand and apply probabilistic and algebraic methods to solve problems in these areas.

Prerequisites: Familiarity with discrete structures (such as MATH 443) is desirable but not imperative. Mathematical maturity is required.

Evaluation: The instructional format for the course will consist of lectures of 3 hours per week. TTh 9:30-11:00, MATX 1118 (We might change the time if there are conflicts with other courses)

The final mark of the course will consist of

- 50% biweekly homework assignments designed to reinforce concepts and skills covered in class
- 50% final exam to assess learning objectives (1) and (2).

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Office: MATH 220

Textbook:

Lovasz (2007) Combinatorial problems and exercises

Important note: The first meeting is on Tuesday, September 9, (at 9:30 in MATX 1118)

